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INTERIM REPORT

This report (SW-152) was written

by Alan Shilepsky

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RESOURCE RECOVERY PLANT IMPLEMENTATION

Interim Report

by Alan Shilepsky*

Interest in resource recovery is growing rapidly. Scores of cities are investigating processing systems that will divert their solid wastes away from incinerators and landfills and back into the economic system, to serve as replacements for expensive fuels and scarce virgin raw materials. Not only does this new approach to the centuries-old garbage problem make economic sense, but it is in accord with the public's demand that wasteful, "throw-away" attitudes be reversed.

Cities caught up in the rush for resource recovery do have a problem though, because they have little to guide them in making choices in this new field. The prior experiences of city officials offer limited guidance to the sophisticated technologies, procurement problems, and management alternatives involved in resource recovery. Consequently, officials often find decisions on resource recovery difficult and perplexing due to the high capital requirements, the wide range of largely unproven alternatives, the market and operational uncertainties, and the range of procurement and management alternatives. They may ultimately decide to wait until they see how other cities implement resource recovery. The result, of course, is that many cities that could solve a major part of their solid waste problem via resource recovery may lose years in the waiting.

The U.S. Environmental Protection Agency (EPA) recognizes the gravity of the problem city officials face. Consequently, EPA's Office of Solid Waste Management Programs (OSWMP) is developing a series of guides that will facilitate the acquisition of resource recovery plants. This series will be based on OSWMP's experiences as well as those of pioneering cities in the resource recovery field.

Entitled Resource Recovery Plant Implementation: Guides for Municipal Officials, this series will examine in detail a variety of important implementation issues, including planning, technology, markets, financing, procurement, contracts, and an accounting format. A separate guide will treat each individual issue and will be published as it is completed. The complete set of Guides will be available in early 1976.

This Interim Report is being made available now to assist those municipal officials who are beginning the task of resource recovery implementation today. A more detailed version is under development, and will be published in March of 1976 as the Planning and Overview Guide of the Implementation Guide series. OSWMP welcomes comments on this report and will consider them during the preparation of the final version.

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*Mr. Shilepsky is a physical scientist/policy analyst in the Resource Recovery Division of the U.S. Environmental Protection Agency's Office of Solid Waste Management Programs.

STEPS TO RESOURCE RECOVERY

Resource recovery, namely the recapture and reutilization of material and energy products from municipal solid wastes, can be accomplished in two ways. Recovered resources can be segregated at the source (e.g. the home) and separately collected, or they can be separated out of the waste stream by means of high-technology mechanical processing systems. The Office of Solid Waste Management Programs recommends both these approaches, but this report concerns itself only with the latter.

There are three major steps to the implementation of high-technology resource recovery: study, selection, and procurement, in that order. Each of these steps is important to eventual success and must be conscientiously executed in its turn. A general description of each follows:

Study. The study step lays the groundwork for the other two steps, for it creates the Task Force that is necessary to bring resource recovery into practice and it generates the knowledge base that is essential for informed choice later on. It also specifies the city's general goals in solid waste management and resource recovery, which are important inputs to the selection step.

Selection. The selection step is the major decision step in resource recovery implementation because through it the city determines the general outlines of the resource recovery package to be procured. This includes questions of technical concept, management alternatives, financing, and strategy for actually procuring the recovery plant. In practice, this step is usually combined with the study step into a single "planning" step, the product of which may be a comprehensive feasibility study and resource recovery plan.

Procurement. The procurement step starts with a conceptual plan for resource recovery and ends with an operating plant. It includes hiring the facility designer and builder, formulating a mutually acceptable legal arrangement between the parties involved in procurement, and securing financing for the system.

The city must obtain the active involvement of experts in each of these three steps. Impartial planning, engineering, and legal assistance is necessary in the study and selection steps in order to devise a workable plan. Later, in the procurement step, a system designer must be chosen to actually design a plant. Project success will depend on how wisely the city chooses and utilizes these various types of assistance as the implementation progresses.

A discussion of the three major steps follows, with emphasis on the issues and problems that OSWMP has found to be most significant to date for cities involved in implementation.

Resource Recovery Task Force

Before any resource recovery effort can begin, those in political authority in the interested city or region must charge a single group--it might be called the Resource Recovery Task Force--to plan a recovery system and shepherd its implementation. A specific set of tasks and a schedule for completing them must be stipulated. The political authority--it may be the mayor or the city or county council--must also assure that the Task Force will be able to execute its responsibility effectively, and does this by providing it with the following three elements necessary for success.

Broad Participation. The Task Force might have as its core an existing group, like the department of public works or the city planner's office, or it could be specially constituted, like an ad hoc interdepartmental committee set up by the mayor. In any case, its effectiveness depends on inputs and participation from all parts of the community that are necessary for success. Besides obvious participants such as the department of public works, the city attorney's office and the budget office, others that might be included are local environmentalists, State officials, private collection and disposal companies, any company that may prove to be a major user of recovered products (e.g. a local electric utility), and neighboring cities, if their wastes will be necessary to make the economics of a plant acceptable.

A Task Force that lacks broad participation brings only one point of view to the planning process, and may devise a plan that contains embarrassing blind spots. For instance, a Task Force composed only of public works officials may develop a recovery plan that can not be implemented for legal or financial reasons, or which overlooks the problem of market acceptability of the recovered products. Likewise, city planners may overlook technical or operational difficulties. Such questions should be raised and settled early in the planning and implementation process while there is still flexibility, and while they can still be adjusted for without a great loss of money, time, or morale. The best way to raise them early is to have a broadly constituted Task Force that will bring many perspectives to bear on the problem.

Sufficient Authority. The Task Force must have enough authority to execute its responsibility effectively, including the authority to hire consultants, negotiate with system designers, and prepare requests for proposals. The Task Force must also have the authority to make recommendations on system designers, financial plans, and contractual arrangements.

Since there are many powers necessary to implementation that are not delegateable by the mayor (or whomever else set up the group), the Task Force must have and maintain access to him, and keep him apprised

of its activities and decisions. In particular, the Task Force must not get so far out in front of him that he can not or will not support it at critical stages in the implementation process.

Adequate Resources. A third Task Force requirement is sufficient resources, in terms of money, time, and manpower. Though cities are often reluctant to allocate large sums of money for planning activities, the investment is well worth it. Cities under one million population can usually contract for resource recovery planning assistance for less than a fraction of a percent of the $10 to $100 million or more a large-scale recovery plant will cost. Therefore, planning assistance can easily pay for itself many times over by helping optimize system selection at the outset.

Personnel resources are even more important than money, because the problems in recovery implementation are complex and far-reaching. The city must commit knowledgeable staff and sufficient time to the activity, especially in the case of the person whose responsibility it is to direct the Task Force and see that its implementation schedule is followed. Not only must the lead person be able, but he also must devote the majority of his time to this assignment; otherwise resource recovery will bog down when his other responsibilities demand attention.

A mistake made in some cities is to set up an ad hoc Task Force comprised solely of the department heads of the relevant city departments, all of whom have concerns much more immediate than resource recovery and who probably focus on this problem only during the infrequently called meetings. Then, if adequate full-time staff support is lacking, and if the leader has as little time for the project as his colleagues, the process will move purposelessly and fitfully, if it moves at all.

Areas for Study

Probably the most important steps city officials take in preparing for resource recovery are the first ones, for a successful system hinges on the quality of the initial planning and analysis. There are many areas that require study at this stage, and the main ones are discussed below.

Local Solid Waste Situation. Obvious items for study include the dimensions of the local solid waste problem. To determine the necessary plant capacity, approximate disposal tonnages must be learned, both on the average and under seasonal fluctuations. Additionally, the increase in local solid waste generation must be projected over the life of the recovery system.

Waste composition, both seasonal and yearly average, is another important factor, especially if the averages differ significantly from national averages. Knowledge of the composition is necessary to determine the marketability and quantities of possible recovered products. For instance, a low aluminum can content would indicate that the economics were not right for add-on aluminum recovery equipment. Effects that

must be anticipated and taken into consideration include changes that may occur from the introduction of other solid waste management strategies, such as a change in collection practices (e.g. separate collection of newspapers) or source reduction (e.g. mandatory beverage container deposits).

Other solid waste system factors that must be surveyed include: current and anticipated disposal costs (to get a baseline for comparison with recovery system economics), the presence of special wastes, and prospective locations for a plant and a residual landfill.

Available Technologies. The Task Force must next consider the range of technologies available for processing and recovering solid waste, and the characteristics of each. Factors for study include the concept itself, its feasibility, its reliability, its projected economics, and the form and quality of the products it generates.

The analysis of technology is a two-step process. First, general information on various technologies can be obtained through seminars and publications prepared by various groups including EPA's Office of Solid Waste Management Programs, the International City Managers Association, the National Association of Counties, and the National League of Cities - U.S. Conference of Mayors. OSWMP, in particular, is demonstrating technologies, evaluating their economics, and is generally serving as an information clearing house for resource recovery information.

Later, with the assistance of technical consultants, the Task Force should select from the general gamut of technologies a few that appear most applicable to its city's needs and circumstances, and concentrate on them in depth. The Task Force, or its representatives, can accomplish this focused study by visiting pilot plants and discussing options with firms that are familiar with the most interesting resource recovery concepts.

Local Markets. Once the Task Force has a feeling for the available technologies and their products, it can analyze the local market situation to determine which of these products can be sold locally, and at what prices. This analysis is crucial, for a suitable agreeable market is essential if the recovery circle is to be closed.

Success hinges on two factors: local industries and economics. First, an industry must be present that can use the recovered product, otherwise it will be nothing more than a residual that must still be disposed. Second, the product must be able to command a sufficiently high price on the market to reasonably offset recovery costs, otherwise it might be cheaper to shut down the plant and haul the incoming wastes to a low cost landfill.

Superficial market studies are insufficient since only a detailed look at local industries can determine if they can use and will buy waste-based products. Nothing can be assumed. For instance, some

cities assume any electric utility can take shredded solid waste as a fuel. But if the utility's boilers burn oil, they may not have the ash-handling capability necessary for utilizing shredded waste. Or, even if a utility does have coal-burning, ash-handling boilers, the boilers may only be fully fired during peak-loading periods (a few hours a day), in which case they may not constitute a viable market for a waste fuel. Specific details are important for ascertaining materials recovery markets also; a scrap dealer may not be willing to pay premium prices (or anything) for a low-quality ferrous material, or a detinner may not want can stock that has been balled up by a shredder and has little exposed surface area.

An adequate market study should identify a number of potential markets and determine the specifications, quantities, and price each would set for recovered products. It should also recognize the possibility of market displacement, where new recovered products may displace old ones from their traditional markets and thus create a new solid waste problem.

Institutional Factors. The final subject for study concerns institutional factors, as distinguished from technical and market factors. These include the legal, organizational, and financial factors that impact on the city's ability to plan a system, procure it, finance it, and operate it. Questions to be raised here include: what are the laws affecting the process by which the city can procure a recovery system; can the city efficiently operate a recovery plant and market the product itself; can the city assure that wastes will be delivered to the plant; what financing options are available to the city; and, how do the financing options relate to different ownership/operation arrangements. The complexity of such considerations can be seen by expanding on just one of these questions, that pertaining to procurement.

Many States allow their cities little flexibility in procuring capital improvements. Often State laws require competitive bidding and forbid negotiated procurements and turn-key construction contracts. Similarly, there may be constraints on the procurement of services, such as prohibitions of long-term contracts. The Task Force must be aware of these constraints so it can determine a workable and legal recovery plan. (Conversely, it may wish to petition its State legislature for remedial legislation.) The interrelation of legal and other institutional factors will become obvious in later sections of this paper.

Setting Local Goals

The Task Force must do more than gather factual information during the study stage; it must also begin to consider the city's various resource recovery goals and their relative importance. Possible goals include low cost, dependability, minimum environmental impact, maximum resource recovery, and minimum land requirements (to forestall a controversial search for a new landfill).

Consideration of goals is important because different goals dictate different approaches to the disposal problem, as is suggested in

Table 1. If cost is the only concern, for instance, then close-in landfill should be considered even in the face of possible citizen dissatifaction. Conversely, if maximum resource recovery is the goal, a sophisticated "total" materials recovery technology may be called for, even in the face of technological and economic uncertainties. Clearly, it is a fallacy to think that any one approach will satisfy all goals equally.

The earlier the Task Force can ascertain its primary goals, the sooner it can eliminate unacceptable systems from consideration. This will speed the decision process and give the Task Force time to concentrate on a few options in depth. It also will benefit any system vendor who might otherwise have gone to a great deal of expense to prepare a proposal for the city only to learn that his system was in conflict with hitherto unstated goals of the Task Force.

Finally, a Task Force that specifies its key goals early is less likely to find itself in the position of merely responding to the proposals of outsiders, and running the risk of failing to acquire an important system feature such as hazardous waste-handling equipment or built-in redundancy because no proposal included such a feature. This would be like a shopper given to impulsive buying who defines grocery needs while pushing the supermarket cart down the aisles, and who forgets to buy the butter because it is not plainly in view. A comprehensive system selection shopping list is needed, and such a list is more easily prepared if the Task Force tries to lay out its goals explicitly beforehand.

Outside Planning/Implementation Assistance

Few cities have all the information and expertise necessary for resource recovery implementation; rather, success will depend on help from the outside. It is important that the Task Force knows what kind of help it needs, where to get it, and how to use it.

Different types of assistance are required at different times in the implementation process. It is useful to make a distinction between the general technical and managerial services required by the Task Force leading up to the choice of a specific technical concept, and the specific engineering design services required once the specific technical concept has been chosen. (In this paper, the term "consultant" is used to designate the provider of the former type of assistance and "system designer" is used to designate the provider of the latter type.) It should be noted that only consulting engineers can be considered as potential providers of both types of services. Management consultants, for instance, would be unable to prepare the engineering drawings required of a system designer, and system contractors with proprietary technologies would be unable to provide the impartial advice required of a consultant.

Consultants. There are a variety of types of consultants who have proven helpful to cities engaged in resource recovery implementation, including consulting engineers, management consultants, legal consultants and financial consultants. They have been called upon to prepare necessary implementation documents like feasibility studies, market analyses,

TABLE 1

SOLID WASTE/RESOURCE RECOVERY GOALS AND THEIR PROGRAM IMPLICATIONS

Goal	Possible Programs
Minimize Cost	·Landfill close-in if possible ·Skim resource cream by separate collection
Minimize Land Requirements Locally	·Stretch present landfill life through volume reduction (e.g., energy recovery) ·Long haul
Minimize Pollution	·Clean up current activity (e.g., install precipitators on incinerator, collect landfill leachate) ·Initiate new non-polluting modes (e.g., resource recovery)
Maximize Resource Recovery	·Initiate separate collection ·Initiate high technology materials recovery system

requests for proposals, and contracts, and to perform functions such as assessing the legality of financial and management packages and evaluating recovery system proposals. Their help is also necessary for other tasks the Task Force lacks the time or the expertise to execute, such as formulating new procurement strategies or writing long-term market and service contracts.

Because of the complexities involved in the overall resource recovery implementation process, the Task Force should require that each consultant it hires has the expertise necessary to execute all the specific tasks he is assigned. This means, for instance, that a consulting engineer or management consultant hired to do a complete planning study must possess or acquire the appropriate personnel to execute the technical, marketing, legal, and financing aspects of the work. Frequently, all of these skills do not reside in a single firm, and then a team approach may be useful.

Cities that hire consulting engineers to develop their resource recovery plans should be sure that the firm it hires is capable of analyzing and evaluating all available resource recovery alternatives. This can be assured by selecting firms with personnel who are familiar with the full spectrum of current technologies, including the more developmental ones like pyrolysis, wet processing, and glass and nonferrous recovery, or who plan to work jointly with such a firm on the project. Consultant teams without a broad focus may tend to recommend approaches that unjustifiably rely on only those technologies with which they are most familiar.

Prior to the choice of a system designer, the Task Force needs impartial advice and should not rely heavily upon any company with a technological ax to grind. Therefore, it should choose as its technical consultant an independent firm rather than any company that is marketing a proprietary process. On the other hand, the Task Force should recognize the potential disinclination of an independent consultant to recommend any process which he might not be able to design, such as a proprietary one. To eliminate any potential bias caused by the possible inducement of subsequent work, one county explicitly excluded the firm that helped plan its system from competing for its design and operation.

Utilization of Consultants. Before the Task Force commits itself to a major resource recovery study, it should perform a rough preliminary study of local conditions to determine if resource recovery is locally possible at all. A quick survey of the city's goals, its existing disposal options, the costs of resource recovery, and the possibility of local markets may rule out resource recovery in the near-term altogether. On the other hand, the preliminary study may indicate the need to retain a consultant to conduct further investigations. Then, the preliminary study would serve as the basis for intelligently hiring and guiding him, by indicating the areas that need more examination.

Guidance is important. The Task Force should require that the consultants perform problem-oriented work geared to the specific situation and problems of the city. This will require that the Task Force expend effort and time itself, planning the consultant's scope of work and monitoring his progress.

The consultant's work should not be confined to gathering general resource recovery information that may have only limited relevance to the city's specific problems. What a Task Force needs and should ask its consultant for is individualized information about how recovery problems and technologies apply to the local situation. For instance, that energy prices are going up is a cliché; what is important is how this national trend affects the prices that nearby markets will pay for specific products that can be generated from local waste. What is needed are the names of companies that might buy, the particular specifications of the products that would be bought, the types and costs of specific technologies that can provide the product, and the procedures involved in actually getting a system underway.

System Designers. It is important during the study stage for the Task Force to obtain direct and specific information on the forms of technology that are available. This is done by initiating discussions with the system designers that are offering to design systems for cities, namely consulting engineering companies and system contractors.

Cities are familiar with consulting engineers and the services they provide in planning capital improvements. In fact, a consulting engineer may already be serving the Task Force as an impartial consultant to analyze resource recovery technologies and formulate a plan. On the other hand, system contractors are relatively new to the experience of cities.

A resource recovery system contractor is a company that has developed a particular recovery concept and has tested it out in a pilot plant operation. Now it is offering to design and construct a scaled-up plant for a city, and possibly to handle other aspects of getting a plant operating, such as financing, operating the plant, and marketing the products. It may subcontract major portions of the work to other companies. For instance, plant design may be subcontracted out to an engineering firm, or operations and residual disposal to a waste management firm.

A distinguishing characteristic of a system contractor is that it is a monolithic legal entity that signs a two-party contract for a resource recovery plan with the city and, therefore, must bear full legal responsibility for plant failure.(1) This is in contrast to the situation where the city retains one party, a consulting engineer, to design a plant, and another party, a construction firm, to build it. Such an arrangement clouds the issue of responsibility if difficulties in performance arise.

Obtaining Preliminary Information. The types of information that the Task Force should acquire from system designers include the following:

- technical aspects --this includes the proposed technology, as well as recovered products, markets, and environmental impacts. Pilot plant experience should also be specified.

- economics--this will include rough estimates of the capital and operating costs of a facility that would suit the city's needs, as well as a rough idea of the revenues that might be expected from the recovered products.

- management packages--this will give the Task Force an idea of the types of institutional arrangements (operation, financing, risk sharing, etc.) that are available. Since the management package has a strong impact on risk, costs, and efficiency, this information is as important as is information about economics and technology.

A good way a Task Force can obtain the above information from system designers is to request qualifications and conceptual proposals from a number of companies through a Request for Qualifications (RFQ). The responses would include detailed information on the company's technical and financial capabilities, as well as a general idea of the type of system each company would propose to build for the city, and under what type of management, cost, and risk arrangements. The city should stipulate that no final contract award would be made on the basis of these proposals, but that they will serve as the starting point for city-company discussions.

The responses to the RFQ will enable the Task Force to eliminate some technical concepts on the basis of the city's particular constraints, such as finances, lack of particular markets, or city goals. Then, the field of possible designers can be narrowed on the basis of whether they offer the type of system and arrangement the city wants and whether they have proven themselves qualified.

It is important to distinguish between an RFQ and a formal Request for Proposals (RFP, to be discussed in detail later), because some cities make the mistake of issuing the latter while they are still in the study stage. A formal RFP calls upon each company to propose a highly specific technical system, including plant layout, equipment specifications, expected product output, etc. The company is also asked to specify the contractual obligations that will exist between the parties, and to bid a fixed price for this package. This is in contrast to the less exacting RFQ, which requires only a conceptual plan and no precise price or contract. Another difference is that the RFP implies an intent on the city's part to make a prompt contract award on the basis of the proposals received, while the RFQ expressly denies this intent.

The problem with using an RFP during the planning stage is that the Task Force is in no position to make a final choice, and it will be using the companies' formal proposals as a means of defining its own needs and goals. It likely will find that it wants a technical and

managerial package that is a combination of many proposals, and will have to throw out all proposals and prepare a new RFP that specifies the city's new requirements. This will be demoralizing and unfair to the bidders who may have spent considerable time and upwards of $50,000 in preparing their proposals.

Careful Pace Required. A recurrent danger in resource recovery decision-making is that a Task Force will seize upon the first resource recovery system that is proposed to it, even though better approaches may be available. This rush to judgment may stem from impatience or from ignorance of other possiblities. It usually occurs when an advocate of a particular type of system is able to convince city officials to buy his system before they have considered in depth the relative strengths and weaknesses of all available systems.

The most troublesome "advocate" to the city is the "blue skies" system promoter who takes advantage of the city's enthusiasm for resource recovery and its ignorance of the actual processes involved. These entrepreneurs themselves may know relatively little about technology, though they are usually sincere in the belief that their system will work if it is "only given a chance!" They may be sure that their 15-ton-per-day pilot plant will readily scale up to 1000-ton-per-day, or they may feel that a pilot plant is not necessary at all. Such naive technological optimism is a danger the city should avoid.

The city should likewise be wary of promoters (or subsidiary companies) who do not have the financial backing to implement their systems themselves, but instead want the city to put up all the necessary capital or, at least, to provide the legitimacy of a city contract so construction funds can be borrowed. The city should also be wary of appeals to extraneous factors such as local pride--if local citizens are involved as inventors or stockholders.

Obviously, the city should avoid an arrangement where its partner in resource recovery has neither proven technical ability nor the capacity to limit the city's financial risk if the system does not perform. For this reason, the Task Force should not closet itself early with a single vendor, but should get information from and maintain contacts with many outside parties, including other system designers and impartial observers like the EPA. Open discussions with many points of view expressed bring out the flaws of the undesirable options, and may save the city money, time, and embarrassment in the long run.

SELECTION

The selection stage is the culmination of the information-gathering and goal-setting of the study stage, and it synthesizes these inputs into a general plan for resource recovery. As already noted, the selection stage is often combined with the study stage into a single phase of the overall process, namely the planning phase. A Task Force, for instance, may prepare a single report combining the conclusions of the selection stage with the justifying backup data of the study stage. Similarly, a consultant may be asked to prepare this comprehensive document. Though, in that case, the Task Force should participate significantly in the selection stage of the consultant's work to insure that the tradeoffs and decisions made reflect the city's goals.

Just as the consultant should coordinate closely with the Task Force during the selection stage, the Task Force must coordinate with the political authorities to which it is responsible, such as the mayor or the city council. Only in this way can it be assured that the decisions reached are understood by, and have the backing of, those who have the power to carry them out.

Major Decisions to be Made

There are a number of individual but interrelated decisions to be made in the selection stage which, when taken together, add up to a complete plan for resource recovery. The individual decision areas include:

a) Site - specific sites for recovery operations and residual disposal must be determined. The problem of winning public acceptance of these must also be considered.

b) Technology - the Task Force must choose between technologies for conversion of waste to energy such as waterwalled incineration, shredded fuel processing, wet pulping, pyrolysis, etc., and must decide between materials recovery options for fiber, ferrous, glass, and aluminum.

c) Markets - specific markets for recovered major products must be established.

d) Operation - operational responsibility must be determined. It can be assigned to the city's department of public works, a newly-constituted public authority, the company that designed the plant, or a local service contractor.

e) Ownership - ownership can be public or private.

f) Financing - a variety of capital financing options are available.

g) Procurement Strategy - this includes choices between using consulting engineers or system contractors, and whether to use an architectural and engineering approach, a turn-key approach, or a full service approach.

h) Schedule - a schedule should be formulated that indicates the time-phasing of all the steps necessary to complete the plan.

Interrelationship of Choices. All of the above decisions must be combined to form a coherent, logical implementation plan. Choices in one category may preclude certain options in another category; for instance, a pyrolysis system may not be procurable from a consulting engineer, or a public operation may make private ownership unlikely. If the Task Force is unsure whether its plan is workable, it must consult with experts.

The Task Force does not have to make its decisions in the order listed above, since "pacing" constraints will vary from city to city. For a city in a budgetary squeeze, the financing decision is paramount. This decision, in turn, would determine the choice of ownership, which would be private in this case. Another city may have procurement laws that forbid design and construction by the same company, thus limiting the Task Force's choice of technology to only those that are available from independent consulting engineers (i.e. do not construct). The Task Force must understand its own city's constraints and the interrelationship between the choices so it can determine which decisions must come first and how they will affect the others.

Some of the general tradeoffs in the various categories are sketched below. Further data and considerations are discussed in other EPA publications.

Technology - Markets

Since each technology has characteristic output products that must be matched against the needs and constraints of potential users, the choice of a technical system must be made concurrently with the identification of markets for recovered products. Shredded fuel resource recovery, for instance, is workable only if there are nearby boilers with ash-handling capability; similarly, glass recovery requires glass furnaces within an economical haul distance.

A city that fails to identify markets at an early date takes the risk of choosing a system that will produce unmarketable outputs. At its worse, this can create a new waste problem, such as the cases of composting plants that surrounded themselves with their unsaleable product. But even if the major "output" is readily disposable, such as steam from a waterwalled incinerator, the economics of the facility may be completely undermined. OSWMP knows of two examples in the United States where steam went unused because the problem of marketing this product was downplayed until after the facilities were constructed.

Other factors besides markets affect the choice of technology. Consider, for example, the effects of risk, ownership, and operation. Concern about risk may lead a city to choose a technology of relatively low efficiency rather than accept the risks associated with a more complex technology whose economics and feasibility are more uncertain. On the other hand, the city might accept the riskier technology if it is to be privately owned and financed, for then it is not the city's investment that is at stake. Finally, the operating mode also affects the choice of technology, for if the city decides to use city personnel, it may want a less sophisticated, more trouble-free technology.

Ownership-Operation

The responsibilities for ownership and for operation of a recovery plant can be distributed between the public sector and the private sector in a number of different ways (Table 2). The table shows that a publicly-owned and-operated facility can be operated either by an established city department or by a newly-formed public authority which is only loosely coupled to existing governments. Similarly, in the rare case of private ownership and public operation, either a city department or an authority would be in charge.(2) Next, a publicly-owned facility could be operated privately either by the system contractor, who built the facility for the city, or by an independent service contractor who had nothing to do with plant design or construction.(3) Finally, a private ownership-private operation situation might occur if the operator had also designed and built the plant (i.e. he was the system contractor and was confident it would work), or if he were a part of a consortium with the system contractor.

The Task Force's choice between these various options depends on a diversity of factors including:

(a) Price. A private company may offer to build its own plant and process the city's wastes for a lower price than the city could do it itself.

(b) Financing. The city may not wish to raise the capital to pay for a plant itself, and may instead let a private company build and own it. The city would repay the company's capital costs by including a debt service component in its per-ton dump fee. This would appear in the city's books as an operating cost rather than a capital cost.

(c) Efficiency. In some cities, the operation of sophisticated facilities by public employees has proven to be unsatisfactory for a number of reasons. These include: union and civil service rules and pay scales that make it difficult to hire and promote only motivated and competent employees, the city's lack of the necessary technical and marketing sophistication, and the lack of profit incentives for public managers to run an efficient operation.

(d) Control. The city may be committed to maintaining direct operational control over its solid waste management system since it may fear that substandard disposal practices or possible plant shutdowns may result if it lacks direct operational authority. Also, it may not wish to give up job opportunities for public employees.

(e) Public Authority Advantages. It may be advantageous to create a public authority to manage resource recovery in an area. An authority may simplify regionalization, facilitate implementation, or be eligible for State funds. A drawback of authorities is that they are less responsive to the public than elected bodies are.

TABLE 2

AGENCIES AND GROUPS THAT COULD TAKE OPERATIONAL RESPONSIBILITY UNDER VARIOUS OWNERSHIP-OPERATIONS ARRANGEMENTS

OWNERSHIP	OPERATIONS: PUBLIC	OPERATIONS: PRIVATE
PUBLIC	•City department •Public authority	•System contractor •Service contractor
PRIVATE	•City department •Public authority	•System contractor •Consortium

Financing

Just as there is a spectrum of ownership-operation options, there is also a wide variety of options for financing resource recovery plants. Table 3 arrays the most commonly discussed possibilities and some of their characteristics. It is seen that tax-exempt financing is possible even under private ownership through the use of Pollution Control Revenue Bonds (PCRB). Other options include equity financing, revenue bonds, and general obligation (GO) bonds.

The financing decision is sensitive to other implementation factors. A city, for instance, may find that it is unable to own a plant itself because public financing options are not open to it. This may be because a) the city is at or near its GO bonding limit, or is unable to get voter approval to float bonds for a recovery plant; or b) the desired plant could not guarantee a secure enough revenue stream to ensure that revenue bonds would be paid off. Under such circumstances, the city would have to give up the idea of public ownership and seek a system contractor that would be willing to finance and construct a facility.

The most often suggested private financing option is the PCRB, which may be used to finance systems in Hempstead, New York, and Dade County, Florida. This mechanism allows a corporation to borrow money at low interest rates by taking advantage of the tax-exempt status of the city whose solid waste will be recovered or of an associated industrial development agency. In effect, the city (or the agency) borrows the money for facility construction. Once the plant is completed, the city leases it to the corporation for the exact amount that will pay off the bonds, interest included. It is the guaranteed stream of lease payments the company promises to the city, and in turn to the bond holders, that guarantees the bonds. Thus, PCRB financing rests on the credit-rating of the company and relieves the city of any responsibility for the debt.(4)

In a common variation on the PCRB approach, a system contractor insulates himself from bankruptcy by creating a subsidiary company. The subsidiary floats the PCRB, runs the plant, and depends on the city's dump fee for its revenues. This arrangement has the effect of transferring the risk of plant failure to the bondholders since, under failure, the city would not pay the dump fee, the bankrupt subsidiary would not pay the lease payment, and the city would not pay the bondholders. Consequently, bond underwriters have been more cautious about floating this kind of PCRB than floating GO bonds or fully secured PCRB's. In fact, in periods of tight money, such high risk obligations are not likely to be marketable at all.

Procurement Strategy

Just as there is more than one technology for recycling municipal solid wastes, there is more than one strategy a city can choose to procure resource recovery services. In fact, when deciding its strategy, a city must make two related choices. The first is who should be the system designer, a consulting engineer who specializes in design and

TABLE 3

COMMON FINANCING OPTIONS

Type	Ownership	Secured by	Comments
Pollution Control Revenue Bonds	Private (see note 5)	Full faith and credit of company	Tax exempt
Equity Financing	Private	Full faith and credit of company	
Municipal Revenue Bonds	Public	Revenue stream (e.g. dump fee)	Tax exempt
General Obligation Bonds	Public	Full faith and credit of city	Tax exempt May require voter approval

engineering services, or a system contractor whose services encompass both design and construction. Related to this choice is the second one, whether to acquire the plant by the traditional architectural and engineering (A & E) approach, or to use a turn-key or full service approach.

These choices are related, since consulting engineers usually offer only the A & E approach, while system contractors usually will only serve on turn-key or full service projects. The methods by which the city hires these different system designers are also distinct, since consulting engineers are usually hired via negotiations, while system contractors are usually hired via a "competitively" bid RFP.(6)

Because the choices of designer and approach are coupled, they need not be discussed separately. The remainder of this section will be organized around the tradeoffs between the alternative approaches. (The techniques by which the services of a consulting engineer or of a system contractor are procured are discussed in the Procurement section of this paper.)

The three procurement approaches--A & E, turn-key, and full service--differ on the basis of how the various responsibilities of design, construction and operation are allocated between the city and the design firm. Table 4 displays the various job assignments. Each approach will now be discussed in detail.

Architectural and Engineering. This is the traditional approach cities have taken to procure public works like schools, bridges, or incinerators. It involves two main steps, the retention of an engineer to draw up plans and specifications for the desired capital improvement and the hiring of a construction contractor to construct the facility from these plans.

In the first step, the city hires an experienced consultant to perform the necessary architectural and engineering services for the desired facility. He is told specifically what the city wants and where to locate it. In the case of Ames, Iowa, for instance, the consultant was told to draw up plans for a plant to be located on East Lincoln Way that would mill and air classify 50 tons of waste an hour, modelled after the St. Louis-Union Electric Company project.

Later, with these plans firmly in hand, the city would go out for construction bids and would award the contract to the construction contractor with the lowest bid. His task would be to order the steel, cement, and process equipment, to hire the laborers, to supervise construction, and to bring the facility to completion.

This approach is almost always coupled with city ownership and operation and with public financing.

TABLE 4

USUAL JOB ASSIGNMENTS UNDER DIFFERENT PROCUREMENT APPROACHES(7)

	Architectural and Engineering	Turn-key	Full Service
Design	consulting engineer	system contractor	system contractor
Let bids	city	system contractor	system contractor
Supervise construction	city or consulting engineer	system contractor	system contractor
Operate	city	city	system contractor
Own	city	city	system contractor

Turn-key. Under the turn-key approach, the city hires a system contractor to design, build, and start up a recovery system for the city for a price. Some pricing arrangements include cost plus fixed or percentage fee, a target price with incentives, or, though rarely, a guaranteed maximum price. As Table 4 shows, the city assigns sole responsibility for the execution of these steps to a single party.

A turn-key approach usually puts the city in the position of not having to accept the plant until it has been shown to operate according to specifications. The contract between the city and the contractor will stipulate acceptance tests that the plant must pass if the city is to take it over and pay for it. If it does not operate as specified in the contract, the city can refuse to accept it, leaving the contractor bearing the capital cost of construction. In reality, of course, the division of losses between the two parties is affected by the strength of the contract, the payment arrangements, and the possibility that the city will be willing to accept an imperfect processing plant as opposed to a continuing solid waste problem. Generally speaking, a turn-key approach involves much less risk to the city than the alternative of constructing its plant via the traditional A & E approach mode.

Full Service. In the case of the full service approach, the system contractor offers the city a resource recovery service instead of a plant. The contractor finances and builds a plant to perform this service. The contractor owns it and is responsible for ensuring that it performs the recovery service throughout the life of the city's disposal contract (Table 4).

The system contractor will usually charge a set dump fee for each ton of solid waste delivered by the city for processing. This fee will vary over the life of the plant, according to escalator and renegotiation clauses in the contract between the city and the contractor. The contractor will make its profit and pay for its plant with the revenues from the dump fee and from the product sales. Contract life must be long enough to enable plant pay-off, usually 15 to 20 years.

A full-service contract shifts even more risk from the city to the system contractor since the system contractor is obligated to perform a certain service at a stipulated price. Cost escalators in the contract may transfer to the city some of the risks of higher than anticipated capital and operating costs, but, as in a turn-key approach, catastrophic failures would be the contractor's worry. (The city, in that case, would still have its solid waste to dispose of, but a performance bond by the contractor could somewhat compensate the city for its trouble.)

Relative Merits of Different Approaches. No one approach fits the needs of all cities. The Task Force's weighing of various factors will determine which approach to follow: A & E, turn-key, or full service.

A & E Approach Advantages and Disadvantages. One advantage is ease of procurement. Many cities planning for resource recovery prefer the A & E

approach because it is easier to perform organizationally since the "rulebook" for it is "tried and tested", and since all the relevant city personnel know what is expected of them. In fact, State laws governing municipal procurement often make deviations from the A & E approach procedures difficult.

Ironically the turn-key and full service approaches to building a recovery plant should be faster than the A & E approach because one party is responsible for design and construction and can save time by ordering major equipment before all the design work is completed. But usually city law and tradition are ill-suited to these approaches and can cancel out the time-saving advantage.

A second advantage of the A & E approach is that it can be potentially the lowest cost solution to a city's problem. If the city hired a system contractor to design, construct, and possibly operate a recovery facility for the city, the cost to the city would include management fees (e.g. hiring and supervising of construction contractors) and a profit for the company. The city would pay a lower total price for the same physical facility by managing the procurement itself via the A & E approach route. Many people do argue that the inherent inefficiency of publicly-managed projects would wash out any savings here, though; the truth of this depends on the particular municipality and its track record in managing public works.

Another cost-reducing feature of the A & E approach is that the city need not pay a premium for the risk of system failure, which it would if a system contractor underwrote that risk. The city does not have the option of refusing a plant if it has accepted the A & E approach drawings from its consultant and farmed them out to a construction contractor. The contractor can only be liable for faults such as failing to put an I-beam where the blueprint specifies or putting too much sand in the cement. A faulty system concept is not his fault.

If the city selects the A & E approach, it is hoping to save the cost of the risk premium a system contractor would charge. The key disadvantage of the A & E approach is on the other side of the risk coin, for if the system fails to operate at the expected price or, worse yet, does not operate at all, the city has a financial and political embarrassment on its hands.

Another potential limitation of the A & E approach is that it is not applicable to those technologies that are patented by system contractors that require a turn-key or full service arrangement. It is also less likely to be used to implement the more developmental, and consequently more risky, technologies, since in those cases cautious city officials will probably prefer to transfer as much risk as possible over to a system contractor.

Turn-key and Full Service Advantages and Disadvantages. Turn-key and full service approaches are especially important today in light of the state of resource recovery technology, which is complex, expensive, and still largely unproven at the scale of operations that many cities

require. It is generally assumed that there may be some scale-up problems when the larger systems are built, even if the pilot plants worked perfectly. Also, even in the best of circumstances, system debugging will be a necessary and non-trivial task. A laundry list of unexpected problems at OSWMP's St. Louis-Union Electric demonstration project gives a sampling of the variety of problems that require solution: materials bridging in conveyors, excessive wear in pneumatic feed pipes, air pollution uncertainties, and fire hazards.

The owner and operator of a recovery plant will have to come to grips with these malfunctions as they occur. From the standpoint of risk, it can be seen that turn-key or full service offers two key benefits for cities:

1. Deferred acceptance. The city bears only a fraction of the risk that these problems will be insoluble, since it pays for the plant only after it is working.

2. Direct experience. Turn-key and full service approaches allow the system developers' engineers to design and start up the plant, increasing the likelihood of success because they developed the concept and they have the most experience with it through their pilot plant work.

Full service has still other features. One is that it involves private ownership, which makes public borrowing unnecessary. Another is that it does not necessitate the city to staff the new plant with its existing sanitation workers, who may be ill-prepared to operate the new technology and possibly may even resent its introduction. A third is that it exempts the city from the problem of marketing the recovered products, transferring that responsibility to the contractor who may have more proficiency in that role anyway.

Most of the disadvantages of turn-key and full service approaches have already been discussed, such as possibly higher cost and the difficulties of procurement. An additional one is the city's loss of control in the selection of specific process equipment and design. This could have significant effect on economics. In the case of turn-key, the system contractor could, in his design, sacrifice operating economics in order to lower initial equipment and construction costs. The city might then be penalized over the lifetime of the plant by paying larger than necessary maintenance and operating costs. In the case of full service, the city may have no recourse in the event that the system contractor, for some reason, fails to install dump fee reducing technological or operational innovations that were unknown when the original contract was signed.

The problem of procuring a system designer to design and construct a resource recovery plant will now be discussed.

PROCUREMENT

Once the Task Force has selected the complete system package it desires, it must procure the services it needs to implement it. Depending on whether the Task Force wants to go the A & E approach, the turn-key, or the full service approach, it will have to retain the services of a system designer, be it a consulting engineer or a system contractor. It is the purpose of this section to examine the methods of doing so.

In the following, the stress will be on the hiring of system contractors, (in particular, on the use of RFP's), because this technique is relatively new to city officials and has proved to be a stumbling block.

Procuring a Consulting Engineer

The A & E approach in which the consulting engineer does the design work is often viewed as a price competitive approach, but this is only half right. The first step is not price competitive in the sense that the lowest bidder gets the contract, for the hiring of a consulting engineer never involves competition on the basis of price; the engineering community recommends against it. This is because bid prices do not reflect the competency and efficiency of the bidders, and a city's choice of a consultant is instead based upon such factors as technical qualifications, professional experience, prior performance, and personal and professional integrity.

Cities normally hire consulting engineers via a process of screening professional proposals, interviewing three to five of the top-ranking firms, and then negotiating a contract and a scope of work with the winner. General factors to be considered in evaluating and ranking are available from professional societies, as are various methods of contracting and compensation.

The second step of the A & E approach is price competitive, as any number of construction firms can respond when the city advertises for bids to construct the facility according to the consulting engineer's plans and specifications. The lowest responsible bidder will win the contract and will construct the facility, or the part he bid on, for the price he bid.

The first step in the A & E approach is the key one: choosing a consulting engineer. The Task Force must assure itself that the consulting engineer it chooses can design a system that will perform satisfactorily and can be constructed at a reasonable price. This assurance can only come from the Task Force's examination of three factors.

- whether the consulting engineer can demonstrate relevant and comprehensive experience in the recovery field. This includes knowledge of solid waste and its problems, as well as knowledge of the particular technology under discussion. One indicator would be experience, having successfully designed a plant of a similar size and technical concept.

- whether the proposed technical concept has been proven anywhere, either at pilot or full-scale size. Since the city's money is at stake in the A & E approach, a "show-me" attitude is in order.

- whether the consulting engineer is confident of the product specifications of the plant's recovered output and whether he has matched them against the input requirements of the local markets. Here again, it is the city's loss if its products are unmarketable.

Not all engineering firms are likely to be able to fulfill the above conditions. The highly specialized nature of resource recovery coupled with the relatively small market for it means that only a relatively few firms will be able to allocate the manpower to study the field in depth and acquire sufficient "hands-on" design experience. Of course, a firm experienced in recovery technology may want to retain a local consulting engineer for his knowledge and perspective on the local disposal system and its problems.

The Task Force should not rest once it has chosen a consulting engineer to begin design; there are many preparations to be made for plant start-up. First, the management framework for the plant must be developed, to determine who will manage it, who will operate it, how the various jobs will be carried out, etc. Ideally, the city and its system designer will have developed "operating manuals" and will have recruited personnel for the facility before construction is complete.

A second task is marketing. The city must not wait until a product is being produced to sign contracts for its purchase; rather this should be an important activity all through the planning, design, and construction stages. If necessary, arrangements can be made to obtain sample products for marketing purposes from similar recovery plants in other cities. Officials of Lane County, Oregon, for instance, obtained shredded, air-classified solid waste from the St. Louis resource recovery plant to use for test-burning purposes in a local electric utility boiler.

With adequate preparation of personnel and other arrangements, the city will be able to begin operations soon after the construction contractor has finished his work.

Finally, the city usually will want an arrangement with the consulting engineer to assist the city during the shakedown phase. It also may want him to redesign any plant features that are found to perform inadequately, possibly without further charge. This is one form of performance guarantee the city can acquire under the A & E approach.

Procuring a System Contractor

The RFP approach for hiring a system contractor requires a great deal of sophistication on the Task Force's part to be successful, both in RFP preparation and in follow-through. The Task Force and its consultants must perform the following steps:

a) prepare an RFP and distribute it to possible bidders,
b) evaluate proposals and choose a winner,
c) negotiate a contract and arrange financing.

After these steps, the winning system contractor will design and construct the facility. Then the contractor will either operate it or turn it over to the city to operate it, depending on whether the arrangement is for the turn-key approach or for the full service approach.

In the following, a general set of rules is offered that will increase the chance of success of the RFP approach. For specific help, the Task Force probably should obtain the services of consultants, for few cities can marshall internally all the necessary technical, managerial, legal, financial, and marketing expertise. To date, consulting engineers and management consultants have been especially helpful to cities, counties, and states involved in RFP preparation and proposal evaluation. It is important to obtain their help early to insure that avoidable complications do not arise in the later stages when they can be rectified only at the price of serious delay and great effort.

Specialized, in depth help is mandatory because one city cannot adopt in its entirety the RFP or procurement procedures of another city, since each city has a unique set of opportunities and constraints. The following rules are intended only as general guidance and are insufficient in themselves to guide a city through a procurement.

Preparing the RFP. The RFP is a major document that details with a high level of specificity the city's desired resource recovery system, how system contractors may bid to provide this system, and how bids will be evaluated. It must be the culmination of the Task Force's and its consultants' conscientious work in the study and selection stages, and its final determination of the city's resource recovery requirements. Once the RFP is distributed to potential bidders, it cannot be amended without embarrassment to the Task Force and inconvenience to the bidders.

Four rules for RFP preparation follow:

1. Specify technical parameters. The RFP must contain specific technical parameters so that bidders know exactly what is desired of them. This means stipulating information like the particular recovery technology, the tonnages, the products local industries might buy, the environmental control standards that must be met, and the disposal techniques for process residuals. (EPA recognizes that in some cases, e.g., where many possible markets exist, a particular technology may not have to be specified. Still, in depth studies and specification of other parameters are required.)

Some cities prefer to set only performance goals in their RFP; they call for a "black box" that must accept a certain input tonnage and must generate a certain output. The output performance specifications may be vague, requiring, for instance, that a certain percentage of input waste be "recovered," but not specifying what, how, or how efficiently.

Some cities set imprecise performance specifications because their competitive bidding laws forbid process specifications that might only allow one system contractor to bid, as might be the case if wet pulping or "Purox" pyrolysis were called for. Other cities do not have a valid reason for setting performance specifications alone. They may just have put off making a choice or they may be "keeping their options open," hoping for a miracle system to come along.

This is unfortunate. The use of performance specifications alone will make the proposal evaluation stage just that much more difficult, since all the bidders will claim that their system can meet them. Some may not, and the Task Force may neither be able to technically evaluate the proposals to the extent that it can determine which can or cannot meet the specifications at the stated cost, nor be able to ascertain the cost-risk tradeoffs involved. (Should it choose the lower cost project that has a higher risk of failure?) Tradeoffs between the competing technologies should be analyzed in the selection stage and, if possible, one should be chosen before proposals are on the table.

This is not to say that performance specifications are unnecessary; they are an important part of the definition of the city's desired system and will have a significant impact on price. The lack of performance specifications will affect proposal comparability. For example, a city may desire a fail-safe processing plant to lower its dependence on its backup landfill. If this requirement for dependable performance is not explicit in the RFP, problems will arise when low-cost, non-redundant systems are proposed and must be evaluated alongside systems with dual processing lines and other reliability-increasing features. The Task Force group may have to decide questions such as:

a) whether a system contractor with an otherwise good proposal should be allowed to revise his bid to include redundancy,

b) whether a high-price proposal can legally be accepted if a non-redundant system proposal was low bid,

c) whether a low-bidding, non-redundant proposal is just being used to "buy into" the project, since the system contractor may plan to raise his price drastically when the redundancy requirements become explicit.

2. Specify organizational arrangements. The RFP must specify the legal, financial, and managerial arrangements required by the city, so that all contractors can bid on the same overall package. This includes who will own and operate the plant, how and who will finance the plant, how dump fees will be paid, how product revenues will be shared, etc. The RFP should also contain a preliminary contract spelling out most of this information and explicitly stating how risks and responsibilities will be divided between the parties and what expectations the city has of the contractor.

These non-technical factors must be spelled out just as the technical specifications must be. Otherwise, it will be difficult to compare bid packages against each other since they may vary in so many factors. Also, the Task Force may find it likes one system contractor's technical ability and another one's management package. If the Task Force had specified a preferred management package in the RFP, the first company could have bid to it and could have given the Task Force all of what it wanted.

Another reason why the non-technical features must be explicit is that they impact strongly on price. Obviously, public versus private financing and 15 versus 20 year amortization periods will affect cost, but so too will contract provision about risks and responsibilities. Suppose the dependability-minded city in number 1 above decided to go full service and to insure reliability by making the cost of shutdowns great by putting a $200,000 per day damage clause in the contract. If the system contractor knows this will be in the contract, he will certainly build in redundancy and make the city pay for it. But if this is not stipulated in the RFP, bidders will propose lower cost, non-redundant systems and will properly balk when the Task Force broaches it later.

Actually, any risk responsibility the Task Force puts upon the system contractor will affect the contingency he will add to his bid price and will thus affect the cost of the total system to the city. So the city must spell out all these risk assignments in the RFP if it is to get a true estimate of cost.

3. Dictate proposal format. The proposal procedure itself should stress comparability by laying down ground rules for proposals that will facilitate their eventual evaluation. The format of the proposals should be dictated; for instance, bid price sheets and a proposal table of contents should be included in the RFP. Of course, if the city's definition of what it wants is vague (10 year, 20 year contract?, city finances, company finances?), such refinements as bid sheets only give a dangerous illusion of comparability, for the factors that are not included on the bid sheets are far more important than the conditional numbers that are.

The appendix gives a listing of the variety of items that might be included in an RFP, from the technical specifications, to the bid format, to the contract. Not all items on this list are necessary, but each should be explicitly considered by the Task Force before being excluded.

4. Require qualifications. The RFP should require that bidders demonstrate technical and financial capability. The Task Force might even pre-qualify bidders in cities where that is legal.

Stressing qualifications is important because it is a rare city that will be able to judge accurately the technical and economic merits of a complex resource recovery proposal, even with the help of a consultant. But it can hedge against the risks of escalating costs, unmarketable products, and process breakdowns by depending on companies with demonstrable prior experience in solid waste and resource recovery, and with the financial capability to stay afloat through the false starts and down periods that are inevitable.

Proven technical experience can often take the form of resource recovery pilot plant work and large-scale solid waste operations. A functioning plant, even of pilot-scale, is worth a thousand advertising brochures.

Financial capability is another qualification cities should require since performance guarantees in the contract do not help the city if they only drive the system contractor to the bankruptcy court. In fact, there is the danger that a small company will assume the city's disposal function long enough for the city to lose its own disposal capability and then find that it can not continue at its quoted disposal price. The company can issue the valid ultimatum: "increase the dump fee or we will go under." All the contract guarantees in the world will not make the city's garbage disappear the next day.

The city might guard against such a scenario by hiring a company with a solid financial background. It might require from bidders things like a strong financial history, substantial assets (or performance bonds), and experience with projects of comparable magnitude. Naturally, if a subsidiary is set up locally to bid a project, the final contracts must look through the subsidiary back to the parent company.

The above bidder qualifications should be called for and considered in the proposals stage, but the city should address itself to this whole question much earlier as well. If a city is sure that a potential bidder will not meet the experience or financial qualifications, it is foolish to allow him to enter a substantive bid. It is hard to throw out a low bidder <u>after</u> he has outlined his plan, especially if the plan has flaws which are obvious only to the technically sophisticated.

Therefore, a pre-qualifying round of bids, where allowed by law, is a good idea. The city can zero in on a particular system concept and call for the technical and financial qualifications of companies with relevant experience. Then, the city can set a minimum standard and narrow the field substantially. It must be remembered, of course, that the remaining bidders are still not "equal" and the lowest bid should not necessarily be accepted; rather, relative capability should still be a criterion in the bidding round to follow, albeit a less important one.

Non-competitive Procurement. An option open to some cities is to bypass the RFP altogether and negotiate directly with one or a few system designers to procure a system. These might be selected on the basis of the RFQ competition (as discussed on page 11). In a new field like resource recovery, it may be as wise to "go with the man," as to "go with the system." The technologies available may be uncertain, but many reputations are not.

A negotiated procurement allows the Task Force to engage in one-to-one discussions phased over many months, during which time it can gain and digest the information needed to choose a system that serves the city's purposes and to develop the outline of a contract that protects its interests. Such negotiations do not necessarily have to lead to a final contract award or preclude concurrent discussions with other companies or outside consultants. Nor do they preclude an eventual RFP, if the city decides that many companies could provide the decided-upon service.

Of course, in most cities, a negotiated award is probably unacceptable, either legally or politically. Negotiated procurement has its advantages. This is testified to by its common use by the private sector.

Proposal Evaluation. Proposal evaluation should be no problem if a good RFP has been prepared because each company will be bidding comparable system packages and the choice will be between "apples and apples." Price can now play the key role in the decision: the construction price if it is a turn-key project, or the dump fee if it is a full service project.

There are some other factors that should still be weighed, such as relative bidder capability and market arrangements. Another is the bidder's management plan for plant construction and start-up, including the personnel to be utilized.

The concern with personnel and management is that an otherwise acceptable bidder may be overly committed, in terms of manpower and finances, because he has commitments in too many cities. A city may be better served by a company that can assign to it its best talent full-time, instead of just one week in four. Also, a company with contracts in only one or two cities will view each as very important, both to its profits and to its reputation, and will work harder in each for an optimized showcase system.

Contract Negotiation. After a system contractor has been selected, a final contract must be negotiated and signed. Though the basis for discussions is the preliminary contract contained in the RFP, deviations from this contract will probably be necessary to accommodate particular needs and concerns of the winning bidder. Substantial deviations should be avoided as they could appreciably affect the cost picture and would be unfair to the bidders who have been eliminated.

Legal and financial counsel at this stage is important, and both the Task Force and the system contractor may wish to retain it. This is especially true in the case of the full service approach because the contract will be complicated since it must span a 15 to 20 year period to assure a reasonable plant payback time. The contract must anticipate the myriad of situations that could occur in this time-new technologies, natural disasters, new laws-and make provisions for them.

City attorneys usually do not have sufficient experience in writing contracts for long-lived, capital-intensive service facilities; they are more familiar with short-term service contracts or outright purchases of capital facilities. Expertise with turn-key and full service contracts will likely be found in law firms that deal with the private sector where long-term contracts are more common.

Financial assistance must be recruited, too, if it has not been done already, to insure that the contract that is signed can be financed. This can be a problem if project financing by PCRB's or municipal revenue bonds is involved. This is because bond buyers must be convinced that the project will succeed and that the bonds can be paid off. Not only does this require that the technical plan get the seal of approval from independent engineers, but that the contract between the city and the contractor insure that a sufficient stream of revenues will be generated to amortize the investment, even in the face of changing solid waste and market conditions over a period of 15 or 20 years. Therefore, provisions that may be necessary include:

a) Put or pay provisions. --requiring that the city pay for a guaranteed minimum tonnage of waste to be processed, whether it is delivered or not,

b) Composition change adjustments. --to compensate the plant operators for changes in the waste stream that affect the recovered product revenues (e.g., can bans, separate collection drives),

c) Price adjustments. --if new environmental standards require further capitalization or more expensive operating procedures.

In effect, the city must be willing to share some or all of the risks of such changes if construction funds are to be raised.

It is to the benefit of all parties that the contract be as explicit as possible to avoid misunderstandings later. Terms like "recovered resources" and "inert residue" must be defined in operational terms that a court can understand. In the case of a turn-key approach, the standards for acceptance of the facility after start-up must be spelled out; requirements that the plant "perform satisfactorily" are vague and unenforceable. Instead, a set of test procedures should be specified.

Such precision is also necessary in the area of environmental standards that the plant must meet. Agreements reached in advance must include: procedures for calling for tests, responsibility for performing the tests, and the method of correcting deficiencies.

In the case of the full service approach, it may be useful to set up in the contract an arbitration board so that adjustments in the city-contractor relationship can be made over the life of the contract as required. Some contingencies are certain to be overlooked, and only an arbitration procedure can give the project the flexibility necessary. A threat to break the contract on a technicality is a very blunt instrument for accommodation ten years down the road.

Construction Completion and Start-up. The construction completion and plant start-up stages should create no problems for the city if a reliable firm has been hired and a comprehensive contract has been written. Technical problems may appear and may be costly to correct, but a clear specification of responsibilities will insure that the contractor will put his effort into solving problems rather then searching for a way to break the contract. And troubleshooting by the system contractor is encouraged if the contract contains financial incentives like delay penalties and dump fees that depend on the quality of processing.

This discussion ends here because, at this stage, the city is beginning to return to familiar ground; if its Task Force has done its work properly, there should be no catastrophic surprises ahead.

FOOTNOTES

1. A system designer need not be a single company, but can be a consortium of companies acting as a single body in relation to the city. Consortiums might include an engineering firm and a construction firm, or an engineering firm, a construction firm, and an operations firm, in a joint venture to handle the city's wastes.

2. Private ownership - public operation is a rare option, but can take place under what financiers call a leveraged lease. Therein, the city could lease a plant from investors who help the city finance the facility in exchange for formal ownership of it and the tax advantages such ownership entails.

3. Arrangements whereby a city contracts out the operation of a city-owned facility to a private firm are rare today, but could become more common if clear benefits are found, such as increased operating efficiency or reduced debt service. A problem might be that the private contractor would feel little incentive to properly maintain the city-owned plant, though.

4. The PCRB mechanism has not yet been used to finance a recovery plant, so there is some uncertainty as to how it will be applied. The U.S. Internal Revenue Service must make determinations about what kinds of plants, and what parts of plants, will be eligible for this tax-exempt financing.

5. Technically speaking, the city owns the facility in the case of a PCRB, hence its tax-exempt status. We have called it private ownership because not only does the company usually have control of the plant for a 20-year period, but often it purchases the plant from the city under a lease-purchase agreement, or installment sale. This added feature entitles the company to investment tax credit advantages in addition to the PCRB's tax-exempt status.

6. Naturally, there are exceptions, such as in Monroe County, New York, where the County is following a modified A & E approach in which a system contractor, selected by an RFP competition, provides only "professional services". This variation was used because the County might have violated New York State's competitive bidding laws if the contractor had been given formal responsibility for construction. Another variation is a negotiated procurement of a system contractor's services. This approach is often impossible under existing laws.

7. This table only indicates those services provided by system designers that relate to plant design, construction, and operation. Other services are also necessary, although they are not included in the table. Regardless of which of the three approaches is followed, cities will require consultants to execute a myriad of tasks, including

performing feasibility studies, surveying markets, drafting authorizing legislation, preparing RFP's, evaluating proposals, preparing contracts, obtaining financing, and acting as a liaison between the city and its chosen system designer. Such services may be provided by consulting engineers, management consultants, law firms, etc.

APPENDIX

ITEMS FOR POSSIBLE INCLUSION IN A REQUEST FOR PROPOSALS FOR A RESOURCE RECOVERY PLANT

I. Technical Specifications

A. Plant Specifications (especially important for turn-key approach construction)

site information - location, geology
waste-receiving facilities - design, capacity, weigh stations
storage facilities - type, capacity
technical concept - e.g., pyrolysis, shredded fuel
equipment specifications - type, capacities, performance guarantees
redundancy and expansion requirements

safety features
pollution monitoring and control features

building specifications
residue disposal - landfill and equipment
facilities for special wastes

B. Performance Standards (especially important for full service contract)

solid waste input - tonnage, composition, fluctuations, special wastes
environmental standards for plant residue storage site

safety standards
recovery specifications - products, quality, tonnage
residue specification - tonnage, composition
dependability

II. Legal Constraints on City and Contractor

solid waste collection and disposal laws
procurement laws
building codes and standards
zoning laws
employment laws (e.g. equal opportunity, minimum wage)
insurance requirements
occupational safety and health standards
tax obligations of plant owner
legal authority of proposal solicitor
budget authorization of proposal solicitor

III. Management Plan

A. Project Phasing

1. Architectural and Engineering Approach
   scope of work for each step
   CE role in construction supervision and shakedown
   allocation of risk and responsibility
   client-engineer relationship
   compensation mode

2. Turn-key Construction
   scope of work for each step
   time allowed
   procedure for certification of step completion
   payment schedules
   penalties for delays, substandard performance

3. Full Service Contract
   start-up dates
   commencement procedures
   city options to buy
   end of term procedures - what belongs to city, option to extend or renegotiate

B. Rights and Responsibility of Parties (especially for full service contract

land arrangements
tax arrangements
financing arrangements
city's right to approve specifications before construction
hours and days of operation - regular and emergency
delivery and weighing procedures
performance criteria for plant
disposal procedures
maintenance procedures
marketing requirements
city's access to plant, books
environmental performance criteria

C. Dispute Resolution Procedures (especially for full service contract)

1. Procedures for determining if environmental, marketing, residual disposal, or general performance criteria are met
   how testing instituted
   who pays for tests
   who tests, and how
   how determination of non-performance made
   how satisfaction given

2. City - contractor liaison board
   members
   meeting frequency
   powers - e.g. dispute settlement, contract amendment

3. Arbitration Procedures

D. Financial Arrangements (for full service contract)

dump fee payment procedures, dump fee escalation formula
resource recovery revenue sharing formula
incentives for efficiency, resource recovery, maintenance, environmentally sound operation

IV. Provision for Unplanned Contingencies (for full service contract)

termination procedures if contract default by either party
facility removal provisions
force majeure - conditions, procedures to follow
option to buy, option to negotiate service contract
non-city waste - whether allowable and whether city gets rebate
unusual or emergency situations - procedures, city's right to be informed
performance bonds
compensation and obligations during overly long shakedown period
fee schedules if no resource recovery
fee adjustments in case of changes in capital costs, operating costs, recovery revenues, waste stream tonnage or composition, environmental regulations, residual disposal costs.

V. Sample Contract (statement in contract language of above stated responsibilities of the parties)

VI. Other Information for Bidders

local tax rate
utility rates and facilities
contact people at local government, city consultant, potential markets
market study

VII. Items Required of Bidder

process description (detailed)
physical layout of plant and equipment
residue disposal site and operating procedures (for full service contract)
environmental impact assessment
material/energy balance
price bid and derivation of cost
market commitments

sample products (specifications)
proposed management plan for project
technical qualifications of company staff
technical experience of company
financial capability of company
managerial capability of company
marketing capability of company

VIII. Proposal Format Information

sample table of contents
bid sheets
bid bond
formats for other required information (e.g. environmental impact assessment, cost derivation)

IX. Proposal Evaluation Process

schedule for RFP process
- proposal due date
- oral presentations
- contract award
- negotiations

evaluation procedure to be followed
evaluation criteria
city option to reject
procedures for communication with officials during solicitation period

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